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TASMANIAN TERTIARY FORAMINIFERIDA

PART 2, chiefly Spirillinacea to Glabratellidae

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(with three text-figures and five plates)

ABSTRACT

In this paper 77 foraminiferal taxa are recorded from the Late Oligocene to Early Miocene marine sediments of northern and northwestern Tasmania. They are recorded following the latest classification proposed by Loeblich and Tappan (1974). All known Tasmanian Tertiary species of the Superfamilies Robertinacea, Spirillinacea and Buliminacea are recorded. Most of the Superfamily Discorbacea is also recorded. Three species which could have been documented in Part 1 of this series are also listed. Of the taxa recorded, 53 are identified as previously described species or as similar to previously described species, 22 are left in open nomenclature and *Epistominella shauni* and *Angulodiscorbis ludbrookae* are described as new. Most species are figured with scanning electron microscope photographs.

INTRODUCTION

This paper is the second of a three- or four-part series on Tasmanian Tertiary foraminifera and follows Part 1 which was published in Vol. 108 of this journal (Quilty 1974). Other introductory comments are common to each paper. Quilty (1972) described the biostratigraphy of the source areas for the material described here and this paper should be read in conjunction with Quilty (1972).

Since Part 1 appeared, a sample of friable yellowish calcarenite has been collected at Ann Bay, Marrawah (Rock sample catalogued as UTGD 84561) and its content is included in the text here. It also contains some species of Superfamily Lituolacea which should be included in Part 1. They are: *Bdelloidina aggregata* Carter (v), *Textularia* sp. indet. (v), *Gaudryina convexa* (Karrer) (v). The locality of the new sample was shown by Quilty (1972, p.36, fig. 9) where outcrops of Tertiary marine rocks are shown in the southeastern corner of Ann Bay.

In addition to the new Marrawah material, further species have been recovered from Cape Barren Island and are recorded here for the first time. The locality was noted by Quilty (1972, p.28).

Two corrections to Part 1 may be noted here - (1) the accession number of *Guttulina regina* is 84224 not 84244, (2) the accession number for *Sigmoidella elegantissima* is 84231 not 87231.

CLASSIFICATION

Since Part 1 of this series was published the classification of the Foraminiferida proposed by Loeblich and Tappan (1964a, b) has been considerably modified and improved by Loeblich and Tappan (1974). The new scheme is followed here. The main improvement involves genera in the Superfamilies Discorbacea and Orbitoidacea and depends on the recognition that the lamellar character of the walls cannot be used for distinction at Superfamily level. The Orbitoidacea is much restricted, and now incorporates only the complex "orbitoid" genera. Morphologically simpler forms originally included in the Orbitoidacea have been transferred to the Discorbacea.

Superfamily LITUOLACEA
Family ATAXOPHRAGMIIDAE

Genus *VALVULINA* d'Orbigny, 1826

Valvulina sp.
(Pl.1, fig. 1)

Occurrence - Cape Barren Island (84554).
Age - Early Miocene, N8.

Superfamily ROTALIACEA
Family NODOSARIIDAE

Genus *LENTICULINA* Lamarck, 1804

Lenticulina rotulata Lamarck, 1804
(Pl.1, figs. 2, 3)

Lenticulites rotulata Lamarck, 1804, *Ann. Mus. natn. Hist. nat. Paris*, 5, 188.
Lenticulites rotulata Lamarck, 1806, *ibid.*, 8, pl. 62, fig. 11.
Occurrence - Cape Barren Island (84554).
Type locality and stratigraphic level - France, Late Cretaceous.
Age - Early Miocene, N8.

Genus *PLANULARIA* Defrance, 1826
Planularia sp.
(Pl. 1, fig.4)

Occurrence - Ann Bay, Marrawah (84561).
Age - Early Miocene, N4/5.

Superfamily ROBERTINACEA
Family CERATOBULIMINIDAE

Genus *CEROBERTINA* Finlay, 1939

Cerobertina bartrumi Finlay, 1939
(pl.1, figs. 5,6)

Cerobertina bartrumi Finlay, 1939, *Trans. R. Soc. N.Z.*, 69 (1), 118, pl. 2, figs. 2-3.
Cerobertina bartrumi; Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 113, pl.11, figs.214-216.
Type locality and stratigraphic level - Pakaurangi Point, New Zealand; Early Miocene.
Remarks
Only one broken specimen was recovered from Brittons Swamp (84480 (v)).
Age - Early Miocene, N8.

Genus *LAMARCKINA* Berthelin, 1881

Lamarckina glencoensis Chapman and Crespin, 1930
(Pl. 1, figs. 7, 8)

Lamarckina glencoensis Chapman and Crespin, 1930, *Proc. R. Soc. Vict.* n.s., 43, 99 pl. 5, figs. 11, 12.
Lamarckina glencoensis; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 80.
Lamarckina glencoensis; Crespin, 1950, *Contr. Cushman Lab. foramin. Res.*, 1, pl. 10, figs. 13a, b.
Lamarckina glencoensis; Raggatt and Crespin, 1955, *Proc. R. Soc. Vict.* n.s., 67, pl. 7, figs. 13a, b.
Lamarckina glencoensis; Carter, 1958, *Bull. geol. Surv. Vict.*, 55, 67, pl. 10, figs. 110-112.
Type locality and stratigraphic level - Victoria, No. 3 Bore, Parish of Glencoe at 30 m; Late Oligocene.

Remarks

This species is found at both Fossil Bluff and Cape Grim. In the Cape Grim samples, the dorsal pustules become smaller and less numerous as the rocks become younger, until in the highest sample, the specimens are completely "bald". The Fossil Bluff and lower Cape Grim specimens are more typical.

Occurrence - (a) Fossil Bluff - Freestone Cove Sandstone, 84010b (v),
Fossil Bluff Sandstone, 84014 (r),
(b) Cape Grim - Cape Grim Beds, 84008 (r), 84007 (q),
84006 (v), 84002 (v), 84001 (v).

Age - Early Miocene, N4/5.

Family EPISTOMINIDAE

Genus *EPISTOMINA* Terquem, 1883

Epistomina elegans (d'Orbigny), 1826
(Pl. 1, figs. 9,10)

Rotalia (Turbinuline) elegans d'Orbigny, 1826, *Annls Sci. nat.* ser. 1, 7, 76.
Rotalia (Turbinuline) elegans (d'Orbigny); Parker, Jones and Brady, 1871. *Ann. Mag. nat. Hist.* ser. 4, 8, pl. 12, fig. 142.
Pulvinulina elegans (d'Orbigny); Chapman, 1910, *Proc. R. Soc. Vict.* n.s., 22, 288.
Pulvinulina elegans; Heron-Allen and Earland, 1924, *J. R. Microsc. Soc.* (1924), 180.
Epistomina elegans (d'Orbigny); Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38 (262), 567, pl. 9, figs. 22a-c.
Epistomina elegans; Howchin and Parr, 1938, *Trans. R. Soc. S. Aust.*, 62, 305.
Type locality and stratigraphic level - Coroncina, Italy, "fossil".
Occurrence - Cape Grim - Cape Grim Beds, 84008 (v), 84006 (v), 84005 (r).
Age - Early Miocene, N4/5.

Superfamily and Family Uncertain

Genus *MISSISSIPPINA* Howe, 1930

Mississippina concentrica (Parker and Jones), 1864
(Pl. 1, figs. 11, 12)

Pulvinulina concentrica Parker and Jones, in Brady, 1864, *Trans. Linn. Soc.*, 24, 470, pl. 48, fig. 14.
Pulvinulina concentrica; Chapman, 1910, *Proc. R. Soc. Vict.* n.s., 22, 287.
Pulvinulina concentrica; Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), 179.
Eponides concentricus (Parker and Jones); Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38 (262), 565, pl. 9, figs. 17a-c.
Eponides concentricus; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 79.
Stomatorbina concentrica (Parker and Jones); Carter, 1958, *Bull. geol. Surv. Vict.*, 55, 40, pl. 4, figs. 37-39; pl. 7, fig. 75.
Stomatorbina concentrica; Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 74.
Mississippina concentrica (Parker and Jones); Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 78.
Type locality and stratigraphic level - Atlantic or Mediterranean Sea, Recent.

Remarks

One of the results to come from the study of this species, is an understanding of the possible structure of the ventral peripheral 'band' on each chamber of the species. A study of sections through this structure shows that the primary lamellae of the wall pass through the structure without interruption, indicating that it is part of the primary wall. Central ventral parts of the test are strongly thickened by many lamellae as is the entire dorsal surface, (excluding dorsal peripheral bands), peripheral keel and sutures.

Many of the conclusions reached here regarding the composition and structure of

the wall support those of McGowran (1966) who had much better material.

The position of the genus *Mississippina* in Loeblich and Tappan's (1974) classification is not clear. McGowran (1966) and the present study have shown that it cannot be placed in the Robertinacea as they envisage it. The wall has both granular and radial calcite elements and thus does not allow a ready fit into any of Loeblich and Tappan's Family or Superfamily categories. Perhaps a better position is as part of the Discorbacea, but its exact allocation is an interesting problem. It is certainly excluded by definition from any existing family. To accommodate it, the Discorbacea would need a proviso added that some members may contain primary monolamellid granular walls with secondary radial laminated calcite. Then a family would need to be erected to contain such forms as *Mississippina*, *Schlosserina* and possibly some other closely related forms.

Occurrence- (a) Mussel Roe Bay - 84483 (r), 84481 (r), 84482 (r),
(b) Fossil Bluff - Fossil Bluff Sandstone, 84024 (v),
(c) King Island - 84084 (v), 84086 (r), 84475 (q), 84476 (r),
(d) Daisy Creek - 84478 (r).
(e) Cape Grim - Cape Grim Beds, 84008 (r), 84007 (r), 84005 (r), 84002 (v), 84001 (v),
(f) Mt Cameron West - 84120 (v),
(g) Preservation Island - 84479 (r),
(h) Redpa - 84093 (v), 84095 (r), 84096 (v),
(i) Marrawah district - 84108 (r), 84110 (v), 84113 (r), 84114 (r), 84104 (r), 84101 (r), 84105 (r).

Age - Late Oligocene - Early Miocene, N3-N8.

Superfamily SPIRILLINACEA
Family SPIRILLINIDAE

Genus *SPIRILLINA* Ehrenberg, 1843

Spirillina decorata Brady, 1884
(Pl. 1, fig. 13)

Spirillina decorata Brady, 1884, *"Challenger" Expedn, Scient. Results, Zool.*, 9, 633, pl. 85, figs. 22-25.
Spirillina decorata; Howchin,1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 11.
Spirillina decorata; Carter,1958, *Bull. geol. Surv. Vict.*, 55, 33, pl. 3, figs. 22, 23.
Type locality and stratigraphic level - Atlantic Ocean, Recent.
Occurrence - Brittons Swamp - 84480 (v).
Age - Early Miocene, N8.

Spirillina inaequalis Brady, 1879
(Pl. 1, figs. 14, 15)

Spirillina inaequalis Brady, 1879, *Q. J. microsc. Sci.*, n.s. 19, 278, pl. 8, fig. 25.
Spirillina inaequalis; Brady,1884, *"Challenger" Expedn, Scient. Results, Zool.*, 9, 631, pl. 85, figs. 8-11.
Spirillina inaequalis; Howchin,1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 11.
?Spirillina cf *inaequalis*; Chapman,1910, *Proc. R. Soc. Vict.*, n.s. 22, 282.
Spirillina inaequalis; Heron-Allen and Earland, 1924, *J.R. microsc. Soc.* (1924), pt. 2, 167.
Spirillina inaequalis; Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38, 559, pl. 8, figs. 4a-c.
Spirillina inaequalis; Crespin,1943, *Palaeont. Bull.*, Canberra, 4, 83.
Type locality and stratigraphic level - Type locality not designated, South Atlantic or Pacific Oceans, Recent.

Remarks

Several species of *Spirillina* seem to be present in the samples studied. However, many specimens are poorly preserved and only three species can be identified.

Spirillina inaequalis is the largest species. It is markedly asymmetrical, one surface a low dome, with whorls clearly visible, the other concave and often smooth, with flush, indistinct sutures. The margin is more or less plane, sometimes concave, with the diameter on the domed side greater than that on the concave side.

The species figured and described by Brady (1879) differs from the specimens studied in that his species may have some obvious ornamentation on the domed side of the test but is otherwise similar.

Occurrence - (a) Fossil Bluff - Freestone Cove Sandstone, 84010b (r),
(b) King Island - 84084 (v), 84086 (r),
(c) Cape Grim - Cape Grim Beds, 84006 (r), 84005 (v), 84003 (q), 84002 (r), 84001 (r),
(d) Brittons Swamp - 84480 (v).

Age - Early Miocene, N4-N8.

Spirillina unilatera Chapman, 1902
(Pl. 1, fig. 16)

Spirillina decorata Brady var. *unilatera* Chapman, 1902, *J. Linn. Soc.*, 28, 410.
Spirillina unilatera; Carter, 1958, *Bull. geol. Surv. Vict.*, 55, 38, 39, pl. 4, figs. 26-29.

Type locality and stratigraphic level - near Funafuti Atoll, Recent.

Remarks

This form differs from *S. decorata* only in having surface pattern restricted to one side.

Occurrence - (a) Fossil Bluff - Fossil Bluff Sandstone, 84012 (r), 84013 (v),
(b) Cape Grim - Cape Grim Beds, 84008 (r),
(c) Brittons Swamp - 84480 (v).

Age - Early Miocene, N4-N8.

Spirillina spp. indet.

Remarks

Several specimens, which are unidentifiable, were recovered. They are poor glauconitic internal moulds or are marred by secondary recrystallization.

Occurrence - (a) Fossil Bluff - Fossil Bluff Sandstone, 84024 (v),
(b) Cape Grim - Cape Grim Beds, 84007 (r),
(c) Mt. Cameron West - 84118 (r), 84121 (v), 84120 (r),
(d) Marrawah district - 84092 (v), 84561 (r).

Age - Early Miocene.

Genus PATELLINA Williamson, 1858

Patellina corrugata Williamson, 1858
(Pl.1, fig.17)

Patellina corrugata Williamson, 1858, *Ray Soc. Publs* (1858), 46, pl. 3, figs. 86-89.
Patellina corrugata; Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), pt. 2, 167.
Patellina corrugata; Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38, 560, pl. 8, figs. 6a, b.
Patellina corrugata; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 82.
Patellina corrugata; Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34, 97, pl. 13, fig. 250.
Patellina sp., Hornibrook, 1961, *ibid.* fig. 251.

Type locality and stratigraphic level - North Atlantic, Recent.

Remarks

The specimens recovered show a range from the form usually figured to one with a very highly pointed dorsal surface. Included in this species are specimens probably the same as *Patellina* sp. (Hornibrook, 1961).

Occurrence - (a) Mussel Roe Bay - 84482 (v),

(b) Fossil Bluff - lower Fossil Bluff Sandstone, 84011 (v), 84012 (v), 84013 (v),
(c) Cape Grim - Cape Grim Beds, 84008 (r), 84006 (v),
(d) Mt. Cameron West - 84118 (r).

Age - Early Miocene, N4/5.

Superfamily BULIMINACEA
Family TURRILINIDAE

Genus BULIMINELLA Cushman, 1911

Buliminella sp. cf. *B. gracilis* Collins, 1953
(Pl. 1, fig. 18)

Type locality and stratigraphic level (*B. gracilis*), Great Barrier Reef, Australia, Recent.

Remarks

The figured specimen differs from *B. gracilis* only in the lack of surface ridges in the later part of the test. The similarities are so strong that it seems almost certain that the form recorded here is a predecessor to *B. gracilis*.

Occurrence - (a) Mussel Roe Bay - 84481 (v).
(b) Fossil Bluff - Freestone Cove Sandstone 84010a (r), 84010b (v); Fossil Bluff Sandstone, 84011 (v).

Age - Early Miocene, N4/5.

Buliminella elegantissima (d'Orbigny), 1839
(Pl. 1, fig. 19)

Bulimina elegantissima d'Orbigny, 1839, VOYAGE DANS L'AMERIQUE MERIDIONALE: FORAMINIFERES (V. Levrault: Strasborg), 5, 51, pl. 7, figs. 13, 14.
Bulimina elegantissima; Howchin,1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 8.
Buliminella elegantissima (d'Orbigny); Cushman,1919, *Proc. U.S. natn. Mus.*, 56, 606.
Buliminella elegantissima; Crespin,1943, *Palaeont. Bull.*, Canberra 4, 77.

Type locality and stratigraphic level - Payta, Peru, Recent.

Remarks

Most species of *Buliminella* in the Tasmanian samples are so closely associated, mainly in the Fossil Bluff samples, that it seems probable that all are varieties of one biological species, and a very variable species at that. All species do seem to intergrade and putting a distinct boundary between for example, *B. elegantissima* and *B. madagascariensis* is very difficult. To help underline this difficulty, one can point to the change from one species name to another of *B. e.* var. *apiculata* to *B. m.* var. *spicata*, when the former name was found to be unavailable (Cushman and Parker, 1947, p.64).

The best specimens of all species of this genus recorded here, are from the lower parts of the Fossil Bluff section.

Occurrence - (a) Mussel Roe Bay - 84483 (v), 84481 (v), 84482 (r).
(b) Fossil Bluff - Freestone Cove Sandstone 84010a (r), 84010b (v),
(c) Marrawah district - 84561 (v), 84114 (v), 84105 (r).

Age - Late Oligocene - Early Miocene, N3-N8.

Buliminella madagascariensis (d'Orbigny), 1826
(Pl. 1, fig. 20)

Bulimina madagascariensis d'Orbigny, 1826, *Annls Sci. nat.* ser. 1, 7, 270, no.17.
Buliminella madagascariensis; Cushman and Parker, 1947, *Prof. Pap. U.S. geol. Surv.* 210-D, 68, pl. 17, figs. 15-17.

Type locality and stratigraphic level - Malagasy, Recent.

Remarks

A single poorly preserved, rather short, inflated specimen, similar to Cushman and Parker's (1947, pl. 17, fig. 17) was recovered from Marrawah (84107).

Age - Early Miocene, N8.

Buliminella spicata Cushman and Parker, 1942
(Pl. 1, fig. 21)

Bulimina elegantissima d'Orbigny var. *apiculata* Chapman, 1907, *J. Linn. Soc.*, 30, 31, pl. 4, fig. 77.
Bulimina elegantissima var. *apiculata*; Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), (2), 143.
Buliminella madagascariensis (d'Orbigny) var. *spicata* Cushman and Parker (*in* Cushman, 1942) - *Bull. U.S. natn. Mus.*, 161 (3), 8, pl. 3, figs. 5, 6.
Buliminella spicata; Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 68.
Type locality and stratigraphic level - Grices Creek, Balcombe Bay, Victoria, Middle Miocene.
Occurrence - (a) Fossil Bluff - Freestone Cove Sandstone 84010a (r); Fossil Bluff Sandstone 84012 (r), 84013 (r),
(b) Marrawah district - 84092 (r).
Age - Early Miocene, N4.

Buliminella sp.
(Pl. 1, fig. 22)

Remarks
A single well-preserved small specimen from Mussel Roe Bay (84482 (v)) is markedly different from the other specimens of *Buliminella* in the sample. It is very similar to a specimen figured by Cushman and Parker (1947, pl. 16, fig. 19) as *B. choctawensis*.
Age - Early Miocene, N4.

Family SPHAEROIDINIDAE
Genus SPHAEROIDINA d'Orbigny, 1826

Sphaeroidina bulloides d'Orbigny, 1826
(pl. 1, figs. 23, 24)

Sphaeroidina bulloides d'Orbigny, 1826, *Annls Sci. nat.* ser. 1, 7, 267.
Sphaeroidina bulloides; Howchin, 1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 11.
Sphaeroidina bulloides; Heron-Allen and Earland, 1924, *J. Linn. Soc.*, (1924), (2), 166.
Sphaeroidina bulloides; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 83.
Sphaeroidina bulloides; Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 69.
Type locality and stratigraphic level - Rimini, Italy, Recent.
Occurrence - (a) Mussel Roe Bay - 84483 (v), 84481 (v),
(b) Fossil Bluff - Fossil Bluff Sandstone, 84015 (f), 84019 (r), 84025 (v), 84025b (v),
(c) Cape Grim - Cape Grim Beds, 84008 (v), 84006 (v), 84005 (v), 84001 (v),
(d) Mt. Cameron West - 84117 (r),
(e) Marrawah district - 84092 (r), 84106 (r).
Age - Late Oligocene - Early Miocene, N3-N8.

Family BOLIVINITIDAE

Genus BOLIVINA d'Orbigny, 1839
Subgenus BOLIVINA d'Orbigny, 1839

Bolivina (Bolivina) retiformis Cushman, 1936
(Pl. 1, fig. 25)

Bolivina scalprata Schwager var. *retiformis* Cushman, 1936, *Spec. Publs Cushman Lab.*, 6, 53, pl. 7, figs. 19a, b.
Bolivina scalprata Schwager var. *retiformis*; Cushman, 1937, *Spec. Publs Cushman Lab.*, 9, 84, pl. 9, figs. 35-37.
Type locality and stratigraphic level - Wadi Sudr, Egypt, Miocene.

Remarks

About six or seven specimens have been recovered, all of which are quite poorly preserved. Although not obvious on the figured specimen the reticulate pattern usually is visible and the species is almost certainly that recorded by Cushman (1937, p.84) from Torquay, Victoria. Another very similar species appears to be *B. aenariensis* (Costa).

Occurrence - (a) Mussel Roe Bay - 84481 (v),
(b) Mt. Cameron West - 84120 (v),
(c) Marrawah district - 84092 (r), 84561 (v), 84104 (v), 84101 (v).

Age - Early Miocene, N4-N8.

Bolivina (Bolivina) sp. C
(Pl. 1, fig. 26)

Remarks

A single specimen of an apparently undescribed species was found in sample 84002 from the Cape Grim Beds at Cape Grim. As it is only one specimen, it is not formally described. In most respects such as peripheral characters, general test outline and chamber arrangement, it is very similar to *B. alata* (Seguenza) (see Cushman, 1937, pl. 13, especially fig. 5). However it has a distinct difference in that the test has a clear raised irregular ridge on each side at the line of junction of the biserial parts of chambers. Each ridge is made of small lateral projections from each chamber roughly perpendicular to the plane of the test. Thus, in section, the test has a cruciform appearance, one axis of the cross being much longer than the other. The test wall is also more coarsely perforate than that of *B. alata*. I have seen a specimen of the same species separated by Mr. D.J. Taylor who has designated it *B.* sp. 15.

Age - Early Miocene, N4/5.

Subgenus BRIZALINA Costa, 1856

Bolivina (Brizalina) finlayi Hornibrook, 1961
(Pl. 1, fig. 27)

Bolivina finlayi Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 75, pl. 9, figs. 169-171.

Type locality and stratigraphic level - Target Gully shell bed, Oamaru, New Zealand, Early Miocene.

Remarks

This name is applied to a single specimen from Fossil Bluff (84024) which has very fine radiating striae on the lower half of its test. It is virtually only a striate form of *B. victoriana*.

Occurrence - Fossil Bluff - Fossil Bluff Sandstone, 84024 (v).

Age - Early Miocene, N4/5.

Bolivina (Brizalina) victoriana Cushman, 1936
(Pl. 2, fig. 1)

Bolivina victoriana Cushman, 1936, *Spec. Publs Cushman Lab.*, 6, 55, pl. 8, figs. 2a, b.
Bolivina victoriana; Cushman, 1937, *Spec. Publs Cushman Lab.*, 9, 104, pl. 12, fig. 15 (not *B. hebes* var. *victoriensis* Cushman, *ibid.* 83, pl. 9, fig. 30).
Bolivina victoriana; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 77.
Bolivina victoriana; Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 76.

Type locality and stratigraphic level - Torquay Bore, Victoria, Oligocene.

Remarks

Taylor (1965, 1966, 1967) has used a series of *Bolivina* lineages in subdividing the sequences found in the Bass Strait and Gippsland Basin bores. One of his series (including his *B.* sp. 12) probably lies within *B. victoriana*.

Typical members of this species are probably best developed in sediments now assigned to the Longfordian stage. Earlier forms (Mussel Roe Bay) and later (upper parts of the Marrawah section) seem to be a little more compressed than the typical

form and some later specimens have slightly elevated sutures.

For additional comments, see *B.* sp. A.

Occurrence - (a) Mussel Roe Bay - 84483 (v), 84481 (v),
(b) Fossil Bluff - Freestone Cove Sandstone, 84010a (v);
Fossil Bluff Sandstone, 84011 (v), 84016 (r), 84017 (r), 84019 (r), 84022 (v), 84025a (r), 84024 (r), 84025b (r),
(c) Cape Grim - Cape Grim Beds, 84008 (v), 84006 (r),
(d) Mt. Cameron West - 84121 (v), 84120 (v),
(e) Brittons Swamp - 84480 (v),
(f) Marrawah district - 84561 (v), 84108 (r), 84110 (v), 84111 (r), 84104 (v), 84105 (r), 84106 (q), 84107 (q).

Age - Late Oligocene - Early Miocene, N3-N8.

Bolivina (Brizalina) sp. A
(Pl. 2, fig. 2)

Remarks

Six specimens were recovered of a species which seems to be a derivative of *B. victoriana*. In the later parts of the test it is compressed with a carinate margin. In the earlier parts it is the same as *B. victoriana*, i.e. it has rounded margins and smooth chamber surface. The later half of the test is very similar to the species figured by Carter (1964, pl. 2, figs. 33, 34) as *B. alata* (Seguenza). It is possible that the three forms form an evolutionary series.

Occurrence - Marrawah district - 84113 (v), 84104 (r).

Age - Early Miocene, N8.

Bolivina (Brizalina) sp. B
(Pl. 2, fig. 3)

Remarks

A small species with a smooth surface, compressed test with rounded margin and seven to eight pairs of chambers was found in three Longfordian samples. It is represented by a single specimen in each. It may be a microspheric form of one of the other species recorded.

Occurrence - (a) Mussel Roe Bay - 84481 (v), 84482 (v),
(b) Fossil Bluff - Fossil Bluff Sandstone, 84017 (v).

Age - Early Miocene, N4/5.

Genus LATEROSTOMELLA de Klasz and Rérat, 1962

Laterostomella sp.
(Pl. 2, fig. 4)

Remarks

A single specimen from the Fossil Bluff Sandstone at Fossil Bluff (84013) is tentatively referred to this genus. It is very similar to *L. guembeliniformis* de Klasz and Rérat as figured by Loeblich and Tappan (1964a, p.C553, fig. 437). The present species has a relatively larger proloculus. Apertural details are not very clear but the aperture is not central in the apertural face, and the outer lip is "somewhat flaring", so the above generic designation is probably correct. It does not appear to have been described as a species of *Bolivina* and is probably a new species. It may bear some relationship to *Bolivina hebes* Macfadyen var. *victoriensis* Cushman.

Age - Early Miocene, N4/5.

Family BULIMINIDAE
Subfamily PAVONININAE

Genus REUSSELLA Galloway, 1933

Reussella ensiformis (Chapman), 1910
(Pl. 2, fig. 5)

Verneuilina ensiformis Chapman, 1910, *Proc. R. Soc. Vict.*, n.s. 22, 271, pl. 52, fig. 1.
Reussella ensiformis; Cushman, 1937, *Spec. Publs Cushman Lab.*, 7, 20.
Reussella ensiformis; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 83.
Reussella ensiformis; Cushman, 1945, *Contr. Cushman Lab. foramin. Res.*, 21, (2), 35, pl. 6, fig. 14.

Type locality and stratigraphic level - Filter Quarries, Batesford, Victoria, Middle Miocene.

Remarks

This species is identified by its elongate test which is, in large specimens, quite strongly tapering at the base but very weakly tapering later on. It is distinct from *R. spinulosa* (Reuss) in lacking spinose extremities on each chamber. It seems unlikely that this species is the same as that figured by Heron-Allen and Earland (1924, pl. 7, fig. 5, 6) as *Verneuilina ensiformis*, because Heron-Allen and Earland's figures seem to show a species with deeply re-entrant sides.

Occurrence - (a) Mussel Roe Bay - 84482 (r),
(b) Cape Grim - Cape Grim Beds, 84005 (r), 84002 (v),
(c) Preservation Island - 84479 (v),
(d) Redpa - 84094 (r),
(e) Marrawah district - 84107 (v).

Age - Early Miocene, N4-8.

Reussella n. sp.
(Pl. 2, fig. 6)

Description

Test free, triserial throughout, with markedly concave faces. Test tapering strongly, maximum width half to two thirds of length from the base. Margins of faces carinate but not spinose. Basal angle = 60°. Length/width ratio 1.3 to 1.5. Test of about eight to ten whorls, poor preservation making accurate assessment difficult. Chambers quite strongly recurved distally. Apertural details not discernible.

Remarks

Only three specimens were recovered. They are 0.55 x 0.37, 0.6 x 0.45, and 0.47 x 0.32 mm respectively. Preservation is quite poor and immersion in refractive index liquids helps little in elucidating details, so the species is not formally named.

It is possible that the species figured by Heron-Allen and Earland (1924, pl. 7, figs. 10, 11) as *Tritaxia pyramidata* Reuss, is actually this species. Their species appears uniserial, but the chamber details are difficult to evaluate in this species. The cross-section of the test, the chamber shape and recurvature of the chambers are all consistent with it being conspecific. Their figures show a slightly more elongate specimen, but this may well fall within the specific variation which is hardly definable from three specimens. Their own note on the species shows that their specimens have a hyaline wall contrasting quite noticeably with the type figures (Reuss, 1862, pl. 1, figs. 9a-c) of *T. pyramidata*.

Similar species include *R. recurvata* (Halkyard) which differs in having almost straight, radial chambers and maximum width near the apertural end. *R. eocena* (Cushman) is probably different in having a lower length/width ratio but again this could perhaps be within the specific variation. Of the described species, *R. eocena* seems the most similar.

Occurrence - Marrawah district - 84114 (v), 84105 (v).

Age - Early Miocene, N8.

Reussella spinulosa (Reuss), 1850
(Pl. 2, fig. 7)

Verneulina spinulosa Reuss, 1850, *Denkschr. Akad. Wiss., Wien*, 1, 374, pl. 47, fig. 12.
Reussella spinulosa (Reuss); Cushman, 1945, *Contr. Cushman Lab. foramin. Res.*, 21 (2), 33, pl. 6, figs. 8, 9.
Reussella spinulosa (Reuss); Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 83.
Type locality and stratigraphc level - Vienna Basin, Miocene.
Occurrence - (a) Fossil Bluff - lower Fossil Bluff Sandstone 84011 (v),
(b) Daisy Creek - 84478 (v),
(c) Cape Grim - Cape Grim Beds, 84008 (r), 84001 (v),
(d) Redpa - 84096 (v),
(e) Marrawah district - 84092 (v), 84561 (v), 84113 (v), 84101 (r), 84106 (r), 84107 (r).
Age - Early Miocene, N4-N8.

Genus TUBULOGENERINA Cushman, 1927

Tubulogenerina mooraboolensis Cushman, 1927
(Pl. 2, fig. 8)

Bigenerina conica Heron-Allen and Earland (Part), 1909, *J. R. microsc. Soc.* (1909), 329, pl. 16, figs. 2-6.
Bigenerina conica; Chapman, 1910, *Proc. R. Soc. Vict.*, n.s. 22, 271.
Bigenerina conica; Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), 140.
Tubulogenerina mooraboolensis Cushman, 1927, *Contr. Cushman Lab. foramin. Res.*, 2 (4), 78.
Tubulogenerina mooraboolensis; Cushman, 1937, *Spec. Publs Cushman Lab.*, 9, 217, pl. 24, fig. 22.
Tubulogenerina mooraboolensis; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 84.
Tubulogenerina mooraboolensis; Ludbrook, 1961, *Bull. geol. Surv. S. Aust.*, 36, 80.
Type locality and stratigraphic level - Filter Quarries, Batesford, Victoria, Middle Miocene.
Occurrence - (a) Fossil Bluff - lower Fossil Bluff Sandstone, 84013 (v),
(b) Brittons Swamp - 84480 (v).
Age - Early Miocene, N4-N8.

Buliminid *incertae sedis*
(Pl. 2, figs. 9, 10)

? Chrysalidina costata Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), 139, pl. 8, figs. 12-14.
Remarks
From Mussel Roe Bay (84481 (v)) was recovered a single well preserved specimen of an apparently undescribed genus. The very small early chambers make analysis of the older part of the test difficult. The later chambers increase rapidly in size and the final chamber has a simple central aperture which is surrounded by very many small supplementary areal apertures. The general growth form is somewhat like that of a *Bulimina*, and very much like that of the species figured by Heron-Allen and Earland (*op. cit.*) as *Chrysalidina costata*. The species is not *Chrysalidina* as that genus is arenaceous.

The unusual final chamber is almost identical with several illustrations of the temporary final chamber associated with reproduction in *Tretomphalus bulloides*. The only difference is that *T. bulloides* does not have a central primary aperture.
Age - Early Miocene, N4/5.

Family UVIGERINIDAE
Genus ANGULOGERINA Cushman, 1927

Angulogerina australis (Heron-Allen and Earland), 1924
(Pl. 2, fig. 11)

Uvigerina canariensis var. *australis* Heron-Allen and Earland, 1924, *J. R. micros. Soc.* (1924), (2), 164, pl. 11, figs. 67-70.

Angulogerina australis (Heron-Allen and Earland); Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 67, pl. 9, fig. 157.

Type locality and stratigraphic level - "Filter Quarry", Moorabool River, Victoria, Miocene.

Occurrence - (a) Mussel Roe Bay - 84481 (v),
(b) Marrawah district - 84561 (v).

Age - Early Miocene N4/5.

Genus EUUVIGERINA Thalmann, 1952
Subgenus HOFKERUVA Vella, 1961

Rather than dismiss Vella's genus *Hofkeruva* outright, as Loeblich and Tappan (1964) have done, I prefer to regard his probably phylogenetically separate groups *Hofkeruva* and *Euuvigerina s.s.* as separate taxonomic entities. Whether these are genera or subgenera is a matter of personal taste and in the long run does not matter a great deal. They are here regarded as subgenera of *Euuvigerina*.

Euuvigerina (Hofkeruva) semiteres (Vella), 1961
(Pl. 2, fig. 12)

Hofkeruva (Tereuva) semiteres Vella, 1961, *Micropaleontology*, 7 (4), 475, pl. 1, figs. 13, 14.

Type locality and stratigraphic level - Mata River, North of Waikopiro Stream junction, New Zealand, Early or Middle Miocene.

Remarks

The species is represented by a few poorly preserved specimens. Ribs are present on early chambers but are rare or absent on the ultimate and penultimate chambers. The range in Tasmania begins earlier than in New Zealand but the termination is very similar.

Occurrence - Marrawah district - 84561 (v), 84110 (v), 84104 (v), 84106 (v).

Age - Early Miocene, N4-N8.

Euuvigerina (Hofkeruva) schwageri (Brady), 1884
(Pl. 2, fig. 14)

Uvigerina schwageri Brady, 1884, *"Challenger" Expedn, Scient. Results, Zool.*, 9, 575, pl. 74, figs. 8-10.

Remarks

The general growth habit of this species is very similar to that of *E. (H.) semiteres* (Vella) but has very strong ribs on the early chambers, in contrast to *E. semiteres* which has finer, sharper ribs. In this feature, there may be some link with *E. (H.) gargantua* (Vella). It is represented by a single specimen.

Occurrence - Marrawah district - 84561 (v).

Age - Early Miocene, N4/5.

Euuvigerina (Hofkeruva) euteres (Vella), 1961
(Pl. 2, fig. 15)

Hofkeruva (Tereuva) euteres Vella, 1961, *Micropaleontology*, 7, (4), 476, pl. 1, figs. 6, 7.

Remarks

A single, large (0.54 mm) specimen of a species with very inflated chambers was recovered from Marrawah (84105). The surface ornament is restricted to very weak longitudinal costae on the earlier one-third of the test. The rest is smooth. Of

those species described by Vella (1961) it seems identical to *E. euteres*, but appears to occur in older rocks in Tasmania than in New Zealand.
Age - Early Miocene, N8.

Euuvigerina (Hofkeruva) sp.
(Pl. 2, fig. 13)

Remarks
This species is unique among Tasmanian Oligo-Miocene forms in possessing short, discontinuous ribs which give the species a very characteristic appearance. The most similar species seems to be *Uvigerina bradyana* Fornasini, which has the same rib character, but the Tasmanian form seems a more robust form which has only ribs as surface pattern. *U. bradyana* also has short surface spines.
Occurrence - (a) Cape Grim - Cape Grim Beds, 84008 (v), 84006 (v),
(b) Marrawah district - 84561 (v).
Age - Early Miocene, N4/5.

Genus SIPHOGENERINA Schlumberger, 1882

Siphogenerina canariensis (d'Orbigny), 1839
(Pl. 2, fig. 16)

Uvigerina canariensis d'Orbigny, 1839, HISTOIRE NATURELLE DES ILES CANARIES; FORAMINIFERES (Bethany: Paris), 2 (2), 138, pl. 1, figs. 25-27.
Uvigerina canariensis; Brady, 1884, *"Challenger" Expedn. Scient. Results, Zool.*, 9, 573, pl. 74, figs. 1-3.
Uvigerina canariensis; Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 65, pl. 8, fig. 143.
?Neouvigerina cf *interrupta* (Brady); Vella, 1961, *Micropaleontology*, 7 (4), 471, pl. 2, fig. 7.
Type locality and stratigraphic level - Canary Islands, Recent.
Remarks
This name is applied here to what is (i) very probably the species which Hornibrook *(op. cit)* identified as *Uvigerina canariensis*, and (ii) very questionably to that figured by Vella *(op. cit)* as *Neouvigerina* cf. *interrupta*. It is possibly distinct from the latter in having an extremely finely hispid surface, not the finely nodose one mentioned by Vella. The figured specimen is uniserial in later chambers and is thus transferred to *Siphogenerina*. It is very similar to Brady's *(op. cit.)* figures.
Occurrence - (a) Fossil Bluff - Freestone Cove Sandstone, 84010a (v);
Fossil Bluff Sandstone, 84011 (r), 84019 (v), 84022 (v), 84025a (v), 84024 (r),
(b) Marrawah district - 84561 (v).
Age - Early Miocene N4/5.

Siphogenerina moorei (Vella), 1961
(Pl. 2, fig. 17)

Neouvigerina moorei Vella, 1961, *Micropaleontology*, 7 (4), 472, pl. 2, fig. 17.
Type locality and stratigraphic level - Mangarara Stream, New Zealand, Middle Miocene.
Remarks
As with many other uvigerinid species, the stratigraphic position is different from similar or identical New Zealand species.
Occurrence - Marrawah district 84561 (v).
Age - Early Miocene N4/5.

Genus TRIFARINA Cushman, 1923

Trifarina bradyi Cushman, 1923
(Pl. 2, fig. 18)

Trifarina bradyi Cushman, 1923, *Bull. U.S. natn. Mus.*, 104 (4), 99, pl. 22, figs. 3-9.
Rhabdogonium tricarinatum (d'Orbigny); Heron-Allen and Earland, 1924, *J. R. microsc.*

Soc. (1924), (2), 158.
Trifarina bradyi; Chapman and Parr, 1926, *J. Linn. Soc.*, 36, 386, pl. 20, fig. 52
Trifarina bradyi; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 84.
Trifarina bradyi; Ludbrook, 1961, *Bull. geol. Surv. S. Aust.*, 36, 20, 26, 34, 49, etc.
Trifarina bradyi; Reed, 1965, *Bull. Am. Paleont.*, 49, (220), 68.
Type locality and stratigraphic level - Atlantic Ocean; Recent.
Occurrence - (a) Mussel Roe Bay - 84481 (v), 84482 (r),
(b) Fossil Bluff - Freestone Cove Sandstone 84010a (r), 84010b (v);
Fossil Bluff Sandstone, 84025a (v), 84025b (v),
(c) Redpa - 84097 (v), 84093 (v), 84094 (r), 84096 (v),
(d) Brittons Swamp - 84480 (v),
(e) Marrawah district - 84092 (r), 84561 (f), 84107 (r).
Age - Early Miocene, N4-N8.

Superfamily DISCORBACEA
Family DISCORBIDAE
Subfamily DISCORBINAE

Genus BUCCELLA Andersen, 1952

Buccella frigida (Cushman), 1922
(Pl. 2, figs. 19, 20)
Rotalia karsteni Reuss, 1855, *Z. dt. geol. Ges.*, 7, (1), 273, pl. 9, fig. 6.
Pulvinulina frigida Cushman, 1922, *Contr. Canadian Biol.*, (1921), 9, 12, (144).
Bucella frigida (Cushman); Anderson, 1952, *J. Wash. Acad. Sci.*, 42 (5), 144, 147, tf. 4-6.
Type locality and stratigraphic level - Canadian Arctic, Recent.
Remarks
While the name *B. frigida* is used for these specimens, it is not quite clear to me that they can be separated from *B. karsteni*.
Occurrence - (a) Cape Grim - Cape Grim Beds, 84008 (r), 84006 (q), 84005 (r), 84001 (r),
(b) Marrawah district - 84561 (v).
Age - Early Miocene, N4/5.

Buccella lotella Hornibrook, 1961
(Pl. 2, figs. 21, 22)
Bucella lotella Hornibrook, 1961, *Palaeont. Bull.*, Wellington 34 (1), 110, pl. 15, figs. 314-316.
Type locality and stratigraphic level - Pukeuri Township, New Zealand, Early Miocene.
Remarks
Several specimens from Redpa and Marrawah are referred to this species. Preservation is generally poor, the specimens appearing hispid due to secondary recrystallization. However, on one specimen, apertural details seen are enough to establish the generic designation and on others, the chamber arrangement is clear enough to suggest that the species is *B. lotella*.
Occurrence - (a) Redpa - 84095 (v),
(b) Marrawah district - 84113 (q), 84114 (v).
Age - Early Miocene, N8.

Genus DISCORBINELLA Cushman and Martin, 1935

Discorbinella araucana (d'Orbigny), 1839
(Pl. 2, figs. 23-25)
Rosalina araucana d'Orbigny, 1839, VOYAGE DANS L'AMERIQUE MERIDIONALE: FORAMINIFERES (Levrault: Strasbourg), 5, (5), 44, pl. 6, figs. 16-18.
Discorbina araucana; Brady, 1884, *"Challenger" Expedn, Scient. Results, Zool.*, 9, 645, pl. 86, figs. 10,11.
Discorbina araucana; Howchin, 1889, *Trans. Proc. R. Soc. Aust.*, 12, 12.

Discopulvinulina (?) *araucana* (d'Orbigny); Barker, 1960, *Spec. Publs. Soc. Econ. Paleont. Miner.*, Tulsa 9, 178, pl. 86, figs. 10, 11.
Type locality and stratigraphic level - near Valparaiso, Chile, Recent.
Remarks
Barker *(op. cit.)* questions the possibility that this species is congeneric with *D. bertheloti* (d'Orbigny) but both species appear to fit well the diagnosis of *Discorbinella*. Following Loeblich and Tappan (1964a, p.C575), *Discorbinella* is preferred to *Discopulvinulina*.
Occurrence - (a) Mussel Roe Bay - 84483 (v), 84482 (r),
(b) Cape Grim - Cape Grim Beds, 84001 (v),
(c) Marrawah district - 84561 (r).
Age - Late Oligocene - Early Miocene, N3-N5.

Discorbinella bertheloti (d'Orbigny), 1839
(Pl. 2, figs. 26, 27; pl. 3, figs. 1, 2)

Rosalina bertheloti d'Orbigny (*in* Barker-Webb and Berthelot), 1839, HISTOIRE NATURELLES DES ILES CANARIES (Bethany: Paris), 2 (2), 135, pl. 1, figs. 28-30.
Discorbis bertheloti (d'Orbigny); Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38, 561, pl. 9, figs. 13a-c.
Rosalina scopos Carter, 1958, *Bull. geol. Surv. Vict.*, 55, 41, pl. 4, figs. 34-36.
Discopulvinulina bertheloti (d'Orbigny); Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34, 106, pl. 14, fig. 286.
Rosalina bertheloti (d'Orbigny); Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 77.
Type locality and stratigraphic level - Canary Islands, Recent.
Remarks
This species is obviously the same one figured and described by Carter (1958, *op. cit.*). However, it is not so clear that it is the species described by Finlay (1940) as *Discorbis scopos*. That species has a more evolute dorsal surface and only about eight chambers in the final whorl, (counting the maximum number visible on the involute dorsal surface and nine or ten chambers (counted in the same way as *R. scopos*).

The species has a closer resemblance to Hornibrook's (1961, pl. 14, fig. 286) figure of *Discopulvinulina* (now *Discorbinella*) *bertheloti* (d'Orbigny), which may in turn have too many chambers per whorl to be d'Orbigny's *Rosalina bertheloti*, the latter possibly having only about seven or eight and a much more acute periphery.

Reed (1965, *op. cit.*) apparently noticed some of the above anomalies and referred the species to *R. bertheloti* d'Orbigny. If it does belong to *D. bertheloti*, that species has seven to ten chambers in the final whorl. A feature, apparently previously unrecorded in this species, noticeable on one specimen, is the occurrence of radial striae on the ventral surface, suggesting a closer relationship with the Glabratellidae than has previously been suggested. It may be that ventral radial striae are a more common feature in the Discorbacea than the literature indicates.
Occurrence - (a) Mussel Roe Bay - 84481 (v),
(b) Fossil Bluff - Freestone Cove Sandstone 84010b (r);
Fossil Bluf Sandstone, 84011 (r), 84012 (q), 84013 (q), 84015 (q), 84017 (r), 84019 (r), 84022 (r), 84023 (q), 84024 (r), 84025a(q), 84025b(q),
(c) Cape Grim - Cape Grim Beds, 84008 (v), 84006 (v),
(d) Mt. Cameron West - 84118 (r), 84121 (r), 84120 (r),
(e) Redpa - 84093 (v),
(f) Marrawah district - 84092 (r), 84111 (r), 84114 (v).
Age - Early Miocene, N4-N8.

Discorbinella sp. cf *D. bertheloti* (d'Orbigny), 1839
(Pl. 3, figs. 3, 4)

Remarks
In two samples from Mt. Cameron West (84120 (v), 84117 (r)) were found specimens of a species close to the species recorded above, but differing from it in having

eleven or twelve chambers per whorl and a more rounded periphery.
Age - Early Miocene, N4/5.

Genus DISCORBIS Lamarck, 1804

Discorbis balcombensis Chapman, Parr and Collins, 1934
(Pl. 3, figs. 5-8, 11-13)

Discorbis balcombensis Chapman, Parr and Collins, *J. Linn. Soc.*, 38 (262), 562, pl. 8, figs. 10a-c.
Discorbis finlayi Dorreen, 1948, *J. Paleont.*, 22, 293, pl. 38, figs. 12a-c.
Rotorbinella finlayi (Dorreen); Bermudez, 1952, *Boln Geol. Minist. Minas. Venez.*, 2, 75.
Discorbis balcombensis; Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 98, pl. 13, fig. 252.
Discorbis balcombensis; Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 77, pl. 3, figs. 64-66.
Discorbis finlayi; Loeblich and Tappan, 1964, *Treat. Invert. Paleont.* C2(2), C574.
Discorbis balcombensis; Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 69.
Type locality and stratigraphic level - Kackeraboite Creek, Port Phillip, Victoria, Miocene.

Remarks

This is a dominant species in the Cape Grim section but is also found in many other samples. Most references to this species mention an opaque dorsal side in which detail is obscured by a thick deposit of laminated calcite. At Cape Grim, as well as such opaque specimens, there are many well preserved specimens in which most detail is clear through translucent calcite.

In most of the samples from Cape Grim, in addition to typical *D. balcombensis*, there is a variety which deserves comment. It occurs in all Cape Grim samples but not in samples from other areas. It has the same variation in preservation as typical *D. balcombensis*. The best material is from 84008, where it is well preserved and not opaque. It is distinct from typical *D. balcombensis* in having a border of coarse pores to the dorsal part of each chamber, a coarsely perforate ventral part of each chamber and slightly posteriorly directed ventral intercameral sutures which have more strongly recurved distal part. There appears to be less variation in maximum diameter/thickness ratio than in typical *D. balcombensis*. It has a very distinct umbilical plug. The entire ventral surface gives the appearance of being much more heavily thickened than in typical *D. balcombensis*. Twenty one specimens of this variety were recovered from 84008. They have been measured for maximum diameter and thickness and the results are plotted in figure 1. Average length is 0.48 mm with a range from 0.35 to 0.77 mm. Average thickness is 0.25 mm with a range from 0.20 to 0.37 mm.

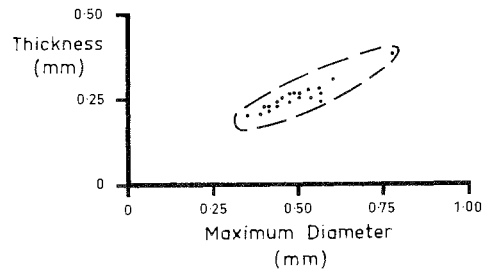

FIG.1 - Thickness vs maximum diameter for *Discorbis balcombensis* Chapman, Parr and Collins

Occurrence - (a) Mussel Roe Bay - 84483 (q), 84481 (r), 84482 (f),
(b) Fossil Bluff - Freestone Cove Sandstone, 84010b (v),
(c) King Island - 84475 (r),
(d) Cape Grim - Cape Grim Beds, 84008 (a), 84007 (a), 84006 (c), 84005 (f), 84003 (f), 84002 (c), 84001 (c),

(e) Granville Harbour - 54144 (r),
(f) Preservation Island - 84479 (q),
(g) Cape Barren Island - 84554 (f),
(h) Marrawah district - 84092 (f), 84561 (r), 84109 (r), 84101 (v), 84105 (q), 84107 (q).

Age - Late Oligocene - Early Miocene, N3-N8.

Discorbis barkeri Mohan and Bhatt, 1968
(Pl. 3, figs. 9, 10)

Discorbina rosacea (d'Orbigny); Brady, 1884, *"Challenger" Expedn, Scient. Results, Zool.* 9, pl. 87, figs. 41-c.
Discorbis sp. nov.; Barker, 1960, *Spec. Publs Soc. econ. Paleont. Miner.*, Tulsa, 9 (180), pl. 87, figs. 4a-c.
Discorbis barkeri Mohan and Bhatt, 1968, *Proc. Nat. Inst. Sci. India*, 34 (B), no. 4, 180, pl. 15, figs. 1a-c.
Type locality and stratigraphic level - *Challenger* Station 162, Bass Strait, Recent.
Occurrence - Mussel Roe Bay - 84481 (r)
Age - Early Miocene, N4/5.

Discorbis spp. indet.

Remarks
Three Marrawah samples and that from Cape Portland contained poorly preserved, unidentifiable specimens.
Occurrence - (a) Cape Portland - 84553 (r),
(b) Marrawah district - 84561 (r), 84111 (r), 84113 (r).
Age - Early Miocene.

Genus EPISTOMINELLA Husezima and Maruhasi, 1944
Epistominella iota Hornibrook, 1961
(Pl. 3, figs. 14-16)

Epistominella iota Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 122, pl. 17, figs. 359, 361, 363.
Type locality and stratigraphic level - Hutchinsons Quarry, Oamaru, New Zealand, Late Oligocene-Early Miocene.
Occurrence - Brittons Swamp - 84480 (v).
Age - Early Miocene, N8

Epistominella shauni Quilty, n. sp.
(Pl. 3, figs. 17-19)

Diagnosis
Epistominella with five to six chambers in the final whorl; the dorsal surface of each chamber with three to four rows of very coarse pores with 16-20 pores in each row. Test with a maximum diameter/thickness ratio of 1.65. Dorsal surface usually more convex than ventral which is almost flat.

Description
Test free, lenticular, roughly circular in plan, trochospiral throughout. Dorsal surface generally a little more convex than ventral. Maximum diameter/thickness ratio 1.65. Dorsal surface evolute, showing 2-2½ whorls with five to six chambers in the final whorl. Proloculus small, about 0.08 mm or less in diameter; covered by a considerable deposit of laminated calcite. Dorsal sutures flush or slightly elevated or depressed; obvious due to their being imperforate and thus different in structure from the rest of the surface. Spiral suture not lobulate. Intercameral sutures very strongly recurved posteriorly distally, the angle of recurvature in adult chambers being of the order of 110°. Early sutures are almost straight, radial and become progressively more strongly recurved during ontogeny. Dorsal surface of each chamber very coarsely perforate. In adult chambers these pores are arranged in three to four rows parallel to the strongly curved anterior intercameral sutures. There are 16-20 pores in each such row in adult chambers but earlier chambers are much less strongly perforate, there being very few which penetrate the central thickened area in the centre

of the dorsal surface. Margin of test quite sharp but rounded and imperforate. Ventral surface involute with central flush umbilical boss. Ventral surface of chambers imperforate in strong contrast to the dorsal surface. Intercameral sutures recurved throughout their length, the amount of recurvature increasing distally at a uniform rate. Septa appear to be thicker proximally, so that the central ventral parts of the sutures are broader and this area has a stellate appearance. Proximal part of each chamber extends to umbilical boss. Aperture in the anterior face of each chamber, completely ventral, mainly an interiomarginal slit without lip, but distally forming a short narrow slit directed away from the suture and becoming parallel to the periphery of the test. This slit is depressed in a 'tucked in' part of the apertural face. With the addition of a new chamber, the apertural face is much resorbed and made into a large, high-arched septal foramen. The aperture is single.

Remarks

Only twelve specimens of the species were recovered, as follows:

(a) Fossil Bluff - Fossil Bluff Sandstone 84011 - 1 specimen (v),
Freestone Cove Sandstone 84012 - 2 specimens (r),
84025a- 3 specimens (r),
84025b- 1 specimen (v);

(b) Mt. Cameron West - 84121 - 2 specimens (v),
84120 - 2 specimens (v);

(c) Marrawah district - 84561 - 1 specimen (v).

All were measured for maximum diameter and thickness, and the results plotted (fig. 2). Average maximum diameter is 0.26 mm with a range from 0.19 to 0.37 mm. Average thickness is 0.16 mm with a range from 0.09 to 0.22 mm.

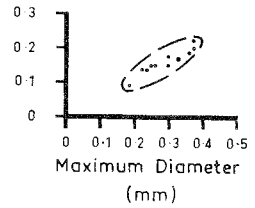

FIG. 2 - Thickness vs maximum diameter for *Epistominella shauni* n. sp.

The species differs from a new species of this genus which occurs in the Late Eocene of southwestern Australia in having only five to six chambers in the final whorl, in being often more convex dorsally, and in being always imperforate on the ventral surface. It also has a lower maximum diameter/thickness ratio.

This species seems closely related to *Svratkina* Pokorny, and it is probable that the genus belongs in the Discorbidae rather than in the Alabaminidae.

There are two groups of species within *Epistominella*. One includes the type species and *E. dubia* Haque (Paleocene), *E. shauni* Quilty (Miocene), *E. pulchra* (Cushman (Recent) and others. The other group contains *E. iota* Hornibrook and could be distinguished as the genus, *Pseudoparrella* Cushman and Ten Dam.

The species is named from a holotype and six paratypes. It is named in honour of my son, Shaun, who was born on the day this description was first penned.

Age - Early Miocene, N4/5.

Genus SVRATKINA Pokorny, 1956

Svratkina australiensis (Chapman, Parr and Collins), 1934

(Pl. 3, figs. 20, 21)

Discorbis tuberculata(Balkiwill and Wright); Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), 169.

Discorbis tuberculata (Balkiwill and Wright) var. *australiensis* Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38 (262), 563, pl. 8, figs. 9a-c.

Discorbis tuberculata (Balkiwill and Wright) var. *australiensis*; Crespin, 1943, *Palaeont. Bull.*, Canberra 4, 79.

Svratkina australiensis (Chapman, Parr and Collins); Pokorny, 1956, *Univ. Carolina*,

Geologica, 2 (3), 257, figs. 1-3.
Alabamina australiensis (Chapman, Parr and Collins); Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 115, pl. 11, figs. 217-219.
Svratkina australiensis (Chapman, Parr and Collins); Loeblich and Tappan, 1964, *Treat. Invert. Palaeont.*, C2(2), C750, fig. 614, 8a-c.
Type locality and stratigraphic level - Altona Coal Shaft, Port Phillip, Victoria, Miocene.
Occurrence - Marrawah district - 84561 (v).
Age - Early Miocene, N4/5.

Genus GAVELINOPSIS Hofker, 1951
Gavelinopsis pukeuriensis Hornibrook, 1961
(Pl. 3, figs. 22, 23)

Gavelinopsis pukeuriensis Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 104, pl. 13, figs. 267, 270, 271.
Type locality and stratigraphic level - Pukeuri Township, New Zealand, Early Miocene.
Remarks
Two imperfectly preserved specimens are tentatively referred to this species. The ventral aspect is identical with that of Hornibrooks' type figure, and the dorsal side is very similar. However, the lateral profile lacks the keel of *G. pukeuriensis*.
Occurrence - Mussel Roe Bay - 84481 (v).
Age - Early Miocene, N4/5.

Genus LATICARININA Galloway and Wissler, 1927
Laticarinina altocamerata (Heron-Allen and Earland), 1922
(Pl. 3, figs. 24, 25)

Truncatulina tenuimargo var. *altocamerata* Heron-Allen and Earland, 1922, *Br. Antarct. ("Terra Nova") Expedn 1910, Zool.*, 6 (2), 209, pl. 7, figs. 24-27.
Parvicarinina altocamerata (Heron-Allen and Earland); Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 118, pl. 14, figs. 296, 299, 301, 302, 305.
Type locality and stratigraphic level - locality not designated, various localities near New Zealand, Recent.
Remarks
A single well preserved specimen was recovered from Cape Grim (84008 (v)) and is tentatively placed here.
Age - Early Miocene, N4/5.

Genus PLANODISCORBIS Bermudez, 1952
Planodiscorbis macropora Carter, 1964
(Pl. 3, figs. 26, 27)

Planodiscorbis macropora Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 89, pl. 6, figs. 113-115.
Type locality and stratigraphic level - Brocks Quarry, Glencoe, Victoria, Early Miocene.
Occurrence - (a) King Island - 84081 (v), 84083 (v),
(b) Marrawah district - 84561 (v).
Age - Early Miocene, N4/5.

Genus PLANULINOIDES Parr, 1941
Planulinoides biconcavus (Jones and Parker), 1862
(Pl. 3, fig. 28)

Discorbina biconcava Jones and Parker (in Carpenter, Parker and Jones) 1862, AN INTRODUCTION TO THE STUDY OF THE FORAMINIFERA, *Ray Soc. Publs* (1862), 201, tab. 32g.
Discorbina biconcava; Parker and Jones, 1865, *Phil. Trans. R. Soc.*, 155, pl. 19 figs. 10a-c.
Discorbina biconcava; Howchin, 1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 12.
Discorbina biconcava; Howchin, 1891, *Trans. Proc. R. Soc. S. Aust.*, 14, 352.
Discorbina biconcava; Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), 173.

Planulinoides biconcavus (Jones and Parker); Parr, 1941, *Min. geol. J.*, 2 (5), 305, text, fig.
Planulinoides biconcavus; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 82.
Discorbinella biconcava (Jones and Parker); Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 86, pl. 5, figs. 97-100.
Planulinoides biconcava; Loeblich and Tappan, 1964, *Treat. Invert. Paleont.*, C2(2), C584, fig. 458, 4-6.
Discorbinella biconcava; Reed, 1965, *Bull. Am. Paleont.*, 49 (22), 69.
Type locality and stratigraphic level - shore sand, Melbourne, Victoria, Recent.
Remarks
Although Loeblich and Tappan (1964a, *op. cit.)* regard *Planulinoides* as a Pliocene-Recent genus, records of the type species were known from pre-Pliocene rocks as long ago as 1889 (Howchin 1889).
Occurence - (a) Mussel Roe Bay - 84483 (v),
(b) Mt Cameron West - 84120 (v),
(c) Marrawah district - 84104 (v).
Age - Late Oligocene-Early Miocene, N3-N8.

Genus ROSALINA d'Orbigny, 1826
Sugbenus NEOCONORBINA Hofker, 1951
Rosalina (Neoconorbina) terquemi (Rzehak), 1888
(Pl. 4, figs. 3-6)

Rosalina orbicularis Terquem, 1876, ESSAI SUR LE CLASSEMENT DES ANIMAUX QUI VIVENT SUR LE PLAGE ET DANS LES ENVIRONS DE DUNKERQUE, (The author: Paris) (2), 75. (Not *Rosalina orbicularis* d'Orbigny, 1850).
Discorbina terquemi Rzehak, 1888, *Verh. K.K. geol. Reichensanst., Wien* (1888) 228.
Rosalina terquemi; Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 101, pl. 13, fig. 272.
Type locality and stratigraphic level - not designated, Mouchy-le-Chatel France, Early Eocene.
Occurrence - (a) Mussel Roe Bay - 84481 (r), 84482 (v),
(b) Brittons Swamp - 84480 (v).
Age - Early Miocene, N4-N8.

Rosalina (Neoconorbina) turbinata (Terquem), 1882
(Pl. 4, figs. 1, 2, 7, 8)

Rotalina turbinata Terquem, *Mem. Soc. geol. Fr.* no. 3, ser. 3, 2, 75, pl. 7, figs. 5a, b.
Discorbis turbinata (Terquem); Le Calvez, 1949, *Mem. Serv. Carte geol. de. Fr.* (1949), 22, pl. 3, figs. 45-47.
Type locality and stratigraphic level - Vandancourt, France, Eocene.
Remarks
The features of the central part of the dorsal surface of this species are not clear in the specimens available. However, the overall shape, ventral features and peripheral dorsal features all match *R. turbinata* well.
Occurrence - (a) Mussel Roe Bay - 84481 (r), 84482 (q), 84483 (v),
(b) King Island - 84084 (q),
(c) Cape Barren Island - 84554 (r),
(d) Marrawah district - 84110 (r), 84114 (r), 84104 (r).
Age - Late Oligocene - Early Miocene, N3-N8.

Subgenus ROSALINA d'Orbigny, 1826
Rosalina (Rosalina) mitchelli Carter, 1964
(Pl. 4, figs. 9, 10)

Rosalina mitchelli Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 73, pl. 3, figs. 54, 55, 56.
Type locality and stratigraphic level - Rosehill, Mitchell River, Victoria, Late Miocene.
Remarks
The specimens recovered are often identical with Carter's (1964, *op. cit.)* figures,

except that there appears to be no ventral imperforate area other than the umbilical flaps, on most specimens.
Occurrence - Cape Grim - Cape Grim Beds, 84008 (q), 84007 (r), 84001 (r).
Age - Early Miocene, N4/5.

Rosalina (Rosalina) vilardeboana d'Orbigny, 1839
(Pl. 4, figs. 11, 12)

Rosalina vilardeboana d'Orbigny, 1839, VOYAGE DANS L'AMERIQUE MERIDIONALE FORAMINIFERES, (P. Levrault: Strasbourg), 5, 44, pl. 6, figs. 13-15.
Type locality and stratigraphic level - Falkland Islands, Recent.
Occurrence - Marrawah district (84561 (r)).
Age - Early Miocene, N4/5.

Rosalina (Rosalina) spp.
(pl. 4, figs. 13, 14)

Remarks

A well preserved, unidentified (possibly new) species of *Rosalina* was recovered from Cape Grim. Another was found at King Island. The latter is of the *R. mitchelli* type but is smaller and more finely perforate.
Occurrence - (a) King Island - 84475 (v),
(b) Cape Grim - Cape Grim Beds, 84006 (v).
Age - Early Miocene, N4/5.

Subfamily BAGGININAE
Genus BAGGINA Cushman, 1926
Baggina sp. cf. *B. philippinensis* (Cushman), 1921
(Pl. 4, figs. 15, 16)

cf *Pulvinulina philippinensis* Cushman, 1921, *Bull. U.S. natn. Mus.*, 4, (100), 331, pl. 58, fig. 2.
cf *Cancris philippinensis* (Cushman); Parr, 1939, *Min. geol. J.*, 1, (4), 69, pl. 1, figs. 18a-c.
cf *Cancris philippinensis;* Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 77.
cf *Baggina philippinensis* (Cushman); Cushman and Todd, 1944, *Contr. Cushman Lab. foramin. Res.*, 20 (4), 105, pl. 17, figs. 1-3.
Baggina philippinensis; Carter, 1964, *Mem. Geol. Surv. Vict.*, 23, 85, pl. 5, figs. 94-96.
Type locality and stratigraphic level (*B. philippinensis*) - Verde Island Passage, Philippines, Recent.
Remarks

The species recorded here seems to be the same as that recorded previously from Australia. However, I am not sure that it is *B. philippinensis*. Cushman and Todd (1944, p.104) noted that *B. philippinensis* has four to five, usually, four, chambers in the final whorl and figured specimens with four to five, whereas Carter (1964, p.85) stated that the Australian species has five to six, and he illustrated a specimen with six. Parr (1939, pl. 1, fig. 18) figured a specimen with five. Cushman and Todd neither mentioned nor illustrated the deeply incised proximal parts of the ventral intercameral sutures - quite a noticeable feature of the Australian species.
Occurrence - (a) Fossil Bluff - Fossil Bluff Sandstone, 84025b (v),
(b) Cape Grim - Cape Grim Beds, 84005 (v),
(c) Mt. Cameron West - 84118 (v).
Age - Early Miocene, N4/5.

Genus CANCRIS de Montfort, 1808
Cancris intermedius Cushman and Todd, 1942
(Pl. 4, figs. 17, 18)

Cancris auricula (Fichtel and Moll); Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38, 567, pl. 10, figs. 24a-c.
Cancris intermedius Cushman and Todd, 1942, *Contr. Cushman. Lab. foramin. Res.*, 18 (4),

88, 89, pl. 22, figs. 11, 12.
Cancris ovatus Cushman and Todd, 1942, *ibid.*, 89, 90, pl. 23, figs. 1, 2.
Cancris intermedius; Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 84, pl. 5, figs. 90-93.
Cancris intermedius; Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 78.
Type locality and stratigraphic level - Western Beach, Geelong, Victoria, Miocene.
Occurrence - Fossil Bluff - Fossil Bluff Sandstone, 84019 (q), 84022 (v), 84025a (v).
Age - Early Miocene, M4/5.

Cancris laevinflatus Hornibrook, 1961
(Pl. 4, figs. 19, 20)

Cancris laevinflatus Hornibrook, 1961, *Palaeont. Bull.* , Wellington, 34 (1), 120, pl. 15, figs. 330-332.
Type locality and stratigraphic level - Otiake, New Zealand, Late Oligocene.
Occurrence - (a) Mussel Roe Bay - 84483 (r), 84481 (v),
(b) Fossil Bluff - Freestone Cove Sandstone, 84010a (v), 84010b (v);
Fossil Bluff Sandstone, 84011 (v), 84012 (r), 84014 (v).
(c) Mt. Cameron West - 84120 (v),
(d) Cape Barren Island - 84554 (v),
(e) Marrawah district - 84092 (v), 84561 (v).
Age - Late Oligocene - Early Miocene, N3-N8.

Genus VALVULINERIA Cushman, 1926
Valvulineria sp.
(Pl. 4, figs. 21, 22)

Remarks
Two specimens somewhat similar to *V. stachei* Hornibrook, were recovered from Fossil Bluff (lower Fossil Bluff Sandstone, 84011, v), and one from Preservation Island (84479). They differ from *V. stachei* in having a more angular periphery and in having a more conical, evolute dorsal side.
Age - Early Miocene, N4/5, N8.

Family GLABRATELLIDAE
Genus ANGULODISCORBIS Uchio, 1953
Angulodiscorbis ludbrookae Quilty, n. sp.
(Pl. 4, figs. 23-25)

Diagnosis
Angulodiscorbis with diameter/spire height ratio of 0.80 and average apical angle of 50°. Test of five whorls, four chambers per whorl. Dorsal surface smooth with depressed sutures and lacking ridges from apex to ventral margin. Ventral surface with large central depression made up of apertures of each chamber.
Description
Test free, a high trochospire, almost conical. Margin of base rounded. Diameter/spire height ratio averages 0.80. Dorsal surface evolute, a high spire, showing five whorls of chambers, four chambers in each of the last four whorls, the details of the first being difficult to see. The equivalent chambers of each whorl form a regular series from apex to base. Apical angle averages 50°. Apex slightly rounded. Apical area sometimes 'ornamented' with minute tubercles. Chambers increase slowly in size. Sutures slightly but clearly depressed. Intercameral sutures recurved posteriorly distally. Surface smooth. Wall finely perforate. Ventral surface involute with central depression and cavity formed of apertures of each chamber. The cavity in the centre of the ventral surface is circular and makes up an appreciable amount of the ventral area. Intercameral sutures straight, radial, slightly depressed. Ventral aspect of chambers globular, inflated. Ventral surface ornamented with fine radial striae.
Remarks
Of fifteen specimens recovered, thirteen are from Fossil Bluff and two from Mussel Roe Bay. Of these, two are from 84010a, nine from 84010b, and one each from 84012, 84025a, 84483 and 84481. Ten are preserved well enough for diameter, spire height and

apical angle to be measured. Average diameter is 0.12 mm with a range from 0.18 mm to 0.24 mm. Average spire height is 0.26 mm with a range from 0.21 mm to 0.29 mm. Apical angle varies from 35° to 50°.

The choice of generic assignation lies between *Glabratella* Dorreen and *Angulodiscorbis* Uchio. The species is not placed in *Pileolina* as it has a rounded margin to the base of the cone. In overall growth pattern, size, etc., it is very similar to *Angulodiscorbis quadrangularis* Uchio. It differs from that species in having more inflated chambers, no striae on the dorsal surface and in being much less quadrangular in section, having no clear ridges on the dorsal surface. Also the dorsal surface is not straight in axial section but is a little convex. The aperture is relatively larger than that of *A. quadrangularis*. It is quite clearly congeneric with *Angulodiscorbis*, but whether *Angulodiscorbis* is a genus in its own right or a subgenus of *Glabratella*, is not so clear. The only notable distinction between the genera seems to be the spire height. As no intermediate forms are obvious between low spired *Glabratella* and high spired *Angulodiscorbis*, the latter name is used. None of the specimens recovered shows any evidence of plastogamy. The type sample (Holotype and 5 paratypes) is taken entirely from 84010b.

Occurrence - (a) Mussel Roe Bay - 84483 (v), 84481 (v),
(b) Fossil Bluff - Freestone Cove Sandstone, 84010a (v), 84010b (r);
Fossil Bluf Sandstone, 84012 (v), 84025a (v).

Age - Late Oligocene - Early Miocene N3-N5.

Repository - (a) Holotype - U.T.G.D. 84355.
(b) Figured paratype - U.T.G.D. 84357
(c) Other paratypes U.T.G.D. 84352-54, 84356.

Angulodiscorbis sp. 2
(Pl. 4, figs. 26, 27)

Remarks

As well as the species described herein as *A. ludbrookae*, there is a single specimen of another, apparently new species from Mussel Roe Bay (84432). This species has a definite recticulate pattern over all the dorsal surface of the test.

Age - Early Miocene, N4/5.

Genus BUENINGIA Finlay, 1939
Bueningia creeki Finlay, 1939
(Pl. 5, figs. 1, 2)

Büningia creeki Finlay, 1939, *Trans. R. Soc. N.Z.*, 69 (1), 122, pl. 14, figs. 82-84.
Bueningia creeki; Loeblich and Tappan, 1964, *Treat. Invert. Paleont.*, C2(2), C589, fig. 464, 6.

Type locality and stratigraphic level - Greymouth, New Zealand, Late Oligocene.

Remarks

A single specimen identical with Loeblich and Tappan's (1964a) figure was recovered from Mussel Roe Bay (84483 (v)).

Age - Late Oligocene, N3.

Genus GLABRATELLA Dorreen, 1948

In this work, the genus *Glabratella* is used in the sense of Dorreen's (1948, p.294) diagnosis of it. His diagnosis is as follows:

"Test inflated, a trochoid spire of few whorls; *chambers globose;* dorsal surface slightly roughened to ornamented; ventral surface smooth, with fine radial striae". (Italics mine).

If only those species with globose chambers are included, *Pileolina* cannot be accepted as a synonym, as species referred to *Pileolina* are generally conical, with non-globular chambers, and with an angled margin, in contrast to *Glabratella* which is not conical, has globular chambers and has a very rounded margin.

Even though the apertural characters of *Valvulina pileolus* may not be well known, there seems ample reason for separating *Pileolina* from *Glabratella*. A more reasonable position for *Pileolina* would appear to be in synonymy with *Discorbis*, as assigned by

Hornibrook (1961, p.98). Following Loeblich and Tappan (1964a, p.C589) *Conorbella* is considered a synonym of *Glabratella*, but *Pileolina* is regarded as a genus in its own right.

From the samples studied, five groups of *Glabratella* have been separated. The dominant, most widespread group is typical *Glabratella crassa* Dorreen, characterised by a globular test and dorsal sutures which are only very little depressed. Another easily identified species is *G. cruciformis* (Howchin). A third is probably *G. globigeriniformis* (Heron-Allen and Earland). The other two groups are rare and possibly new species but are only recorded informally.

Glabratella crassa Dorreen, 1948
(Pl. 5, figs. 3, 4)

Glabratella crassa Dorreen, 1948, *J. Paleont.*, 22 (3), 294, pl. 39, fig. 1.
Glabratella crassa; Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 108, pl. 14, fig. 289.
Glabratella crassa; Loeblich and Tappan, 1964, *Treat. Invert. Paleont.*, C2(2), C588. fig. 464, 1.
Type locality and stratigraphic level - Near Greymouth, New Zealand, Late Eocene.
Remarks
This is the most abundant *Glabratella* in the Tasmanian Tertiary occurring mainly in the Cape Grim section. It commonly has a somewhat flattened central part to the ventral surface. This is construed as being formed during an attached life or as a result of a plastogamic union. The latter is a little unlikely as no plastogamic pairs have been recorded.
The figured specimen shows weak development of dorsal sculpture.
Occurrence - (a) Mussel Roe Bay - 84483 (v), 84481 (r),
(b) Fossil Bluff - Fossil Bluff Sandstone, 84012 (v),
(c) King Island - 84084 (v), 84477 (r),
(d) Cape Grim - Cape Grim Beds, 84008 (q), 84007 (q), 84006 (q), 84005 (r), 84002 (v), 84001 (r),
(e) Granville Harbour - 54144 (q),
(f) Marrawah district - 84561 (v).
Age - Late Oligocene - Early Miocene, N3-N8.

Glabratella cruciformis (Howchin), 1889
(Pl. 5, figs. 5, 6)

Discorbina cruciformis Howchin, 1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 12, 13, pl. 1, figs. 13, 14.
Discorbina cruciformis; Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), (2), 171, pl. 11, figs. 74-77.
Glabratella cruciformis (Howchin); Dorreen, 1948, *J. Paleont.*, 22, 294.
Type locality and stratigraphic level - Muddy Creek, Victoria, Miocene.
Remarks
This is probably the most easily identified species of this genus and is distinguished by its strongly tuberculate dorsal surface.
Occurrence - (a) Mussel Roe Bay - 84481 (v),
(b) Fossil Bluff - Freestone Cove Sandstone, 84010a (r),
(c) Cape Grim - Cape Grim Beds, 84008 (v), 84006 (r), 84005 (v),
(d) Preservation Island - 84479 (r).
Age - Early Miocene, N4/5, N8.

Glabratella globigeriniformis (Heron-Allen and Earland), 1924
(Pl. 5, figs. 7, 8)

Discorbina globigeriniformis Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), (2), 171, pl. 13, figs. 96-98.
Glabratella globigeriniformis (Heron-Allen and Earland); Dorreen, 1948, *J. Paleont.*, 22, 294.
Type locality and stratigraphic level - "Filter Quarry" Moorabool River, Victoria,

Miocene.

Remarks

From Cape Grim (84008, (r) and 84005, (r)) a few specimens of a species with a lower trochospire than *G. crassa*, five chambers in the final whorl and a distinct dorsal sutures, are referred to this species. The dorsal surface is a little roughened but not so much as is suggested by Heron-Allen and Earland's figures. The aperture is relatively larger than those shown in the type figures.

Age - Early Miocene, N4/5.

Glabratella sp. 1
(Pl. 5, figs. 9, 10)

Remarks

A single specimen of an apparently undescribed species was recovered from Fossil Bluff (Fossil Bluff Sandstone, 84012). It is distinct from other species in that it has a low trochospiral growth form, low rate of increase of chamber size, five chambers in the final whorl, a small umbilical depression and a higher maximum diameter/thickness ratio than is normal for *Glabratella*.

Age - Early Miocene, N4/5.

Glabratella sp. 2
(Pl. 5, figs. 11, 12)

Remarks

A single specimen of an apparently undescribed species was recovered from King Island (84084). It is a robust specimen with a low domed dorsal surface with a series of nodes on it. The ventral surface is a truncate cone, the truncation representing the margin of the umbilicus, which is made up of a series of apertures. The truncated part of the cone has a depressed centre and the radial striae, characteristic of the family are restricted to the interior sides of the depression.

The general features of the specimen suggest a possible relationship with *Schackoinella wadeae* Quilty (Quilty 1975).

Age - Early Miocene, N4/5.

Genus HERONALLENIA Chapman and Parr, 1931

Heronallenia lingulata (Burrows and Holland), 1895
(Pl. 5, figs. 13, 14)

Discorbina lingulata Burrows and Holland, (*in* Jones) 1895, *Palaeontogr. Soc. Monogr.* (1895), pl. 7, figs. 33a-c.

Heronallenia lingulata (Burrows and Holland); Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38, 564, 565, pl. 8, figs. 11a-c.

Heronallenia lingulata; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 80.

Heronallenia lingulata; Carter, 1958, *Bull. geol. Surv. Vict.*, 55, 42, 43, pl. 5, figs. 40-42.

Heronallenia lingulata; Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 92, pl. 6, figs. 124-126.

Heronallenia lingulata; Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 69.

Type locality and stratigraphic level - England, Pliocene.

Occurrence - (a) Mussel Roe Bay - 84481 (v),
(b) Cape Grim - Cape Grim Beds, 84008 (v), 84006 (v), 84001 (v),
(c) Mt. Cameron West - 84121 (v), 84120 (v),
(d) Brittons Swamp - 84480 (v),
(e) Marrawah district - 84092 (v), 84113 (v), 84104 (v).

Age - Early Miocene, N4-N8.

Heronallenia parri Carter, 1958
(Pl. 5, figs. 15, 16)

Discorbina wilsoni Heron-Allen and Earland, 1924, *J.R. microsc. Soc.* (1924) (2), 172. (Not Heron-Allen and Earland, 1922).

Heronallenia wilsoni (Heron-Allen and Earland); Chapman and Parr, 1931, *Proc. R. Soc. Vict.* n.s. 43 (2), 237, pl. 9, fig. 7.
Heronallenia wilsoni; Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38, 564, pl. 8, figs. 12a-c.
Heronallenia wilsoni; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 80.
Heronallenia parri Carter, 1958, *Bull. geol. Surv. Vict.*, 55, 43, 44, pl. 5, figs. 43-45.
Heronallenia parri; Carter, 1964, *Mem. geol. Surv. Vict.*, 23, 92, 93.
Heronallenia parri; Reed, 1965, *Bull. Am. Paleont.*, 49 (220), 69.
Type locality and stratigraphic level - Aire Coast, Victoria, Late Oligocene.
Occurrence - (a) Mussel Roe Bay - 84483 (r),
(b) Fossil Bluff - Fossil Bluff Sandstone, 84011 (v), 84025a (v), 84024 (r),
(c) King Island - 84085 (v),
(d) Cape Grim - Cape Grim Beds, 84006 (v),
(e) Granville Harbour - 54144 (r),
(f) Redpa - 84095 (v),
(g) Cape Barren Island - 84554 (v),
(h) Marrawah district - 84110 (v).
Age - Late Oligocene - Early Miocene, N3-N8.

Genus PILEOLINA Bermudez, 1952

General Remarks

As stated before in this work, *Glabratella* is used in the sense that it was defined by Dorreen (1948).

If only those species with globose chambers are included, *Pileolina* cannot be accepted as a synonym, as species referred to *Pileolina* are generally conical, with nonglobular chambers, and with an angled margin, in contrast to *Glabratella* which is not conical, has globular chambers and has a very rounded margin.

Even though the apertural characters of *Valvulina pileolus* may not be well known, there seems ample reason for separating *Pileolina* from *Glabratella*. Hornibrook placed *Pileolina* in synonymy with *Discorbis*, the best allocation if *Pileolina* is not a valid genus. However, *Pileolina* is here regarded as a genus in its own right as noted earlier (see *Glabratella*).

Furthermore, rather than place *Pileolina* in the Glabratellidae, it could well be regarded as belonging to the Discorbidae. The bases on which it was placed in the Glabratellidae by Loeblich and Tappan are (a) it must have an umbilical aperture, (b) it has a flattened or concave, radially striate or grooved ventral surface, (c) it has triflagellate gametes, and (d) it commonly exhibits plastogamy.

Many of the species referred to *Pileolina* do not have an indisputably umbilical aperture. Many of the specimens found here appear to have an interiomarginal aperture. This is a character compatible with a position in the Discorbidae.

A flattened or concave ventral surface is a common character in the Discorbidae and there seems to me no reason why a radially striate surface should be restricted to the Glabratellidae. *Discorbinella bertheloti* (*q.v.*) occasionally has a radially striate ventral surface.

The triflagellate gamete character for the Family Glabratellidae is probably based on *Pileolina patelliformis* so this character goes wherever the species goes.

The only problem with the transfer of this genus to the Discorbidae is that of plastogamy. Plastogamy does not appear to be common in the Discorbidae, and this is the only character which is here regarded as being very significant.

Pileolina australensis (Heron-Allen and Earland), 1932

(Pl. 5, fig. 17)

?Discorbina pileolus; Howchin, 1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 12. (not *D. pileolus* Brady 1884).
?Discorbina pileolus; Chapman, 1910, *Proc. R. Soc. Vict.* n.s., 22, 282.
?Discorbina pileolus; Heron-Allen and Earland, 1924, *J.R. microsc. Soc.* (1924) (2), 170.

Discorbis australensis Heron-Allen and Earland, 1932, *"Discovery" Repts*, 4 (1), 416.
Discorbis pileolus (Heron-Allen and Earland); Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 79.
Pileolina (?) *australensis* (Heron-Allen and Earland);BBarker, 1960, *Spec. Publs Soc. econ. Paleont. Miner.*, Tulsa, 9, 184, pl. 89, figs. 2-4.
Type locality and stratigraphic level - Challenger Station 163B, Port Jackson, Recent.
Remarks

This is the same species as figured by Barker (1960 *op. cit.*). It is a common species in the Cape Grim section and several hundred specimens have been recovered, up to 2/3 of specimens being recovered in plastogamic pairs. The single specimen from Marrawah (84114, (v)) is only tentatively identified.

Occurrence - (a) Cape Grim - Cape Grim Beds, 84008 (c), 84007 (q), 84006 (v), 84005 (r) 84003 (v), 84002 (q), 84001 (f),
(b) Marrawah district - 84114 (v).

Age - Early Miocene, N4-N8.

Pileolina sp. cf. *P. opercularis* (d'Orbigny), 1839
(Pl. 5, figs. 18, 19)

Discorbina opercularis d'Orbigny; Brady, 1884, *"Challenger" Expedn, Scient. Results, Zool.*, 9, 650, pl. 89, figs. 8, 9. (?*D. opercularis*, d'Orbigny, 1839).
Discorbina opercularis; Howchin, 1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 12.
Discorbina opercularis; Chapman, Parr and Collins, 1934, *J. Linn. Soc.*, 38, 562, pl. 8, figs. 8a-c.
Discorbina opercularis; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 78.
Pileolina (?) *opercularis* (d'Orbigny); Barker, 1960, *Spec. Publs Soc. econ. Paleont. Miner.*, Tulsa 9, 184, pl. 89, figs. 8, 9.
Type locality and stratigraphic level (*P. opercularis*)-Cuba, Recent.
Remarks

This species is the same described and figured by Brady (1884, *op. cit.*) and Barker (1960, *op. cit.*) and is fairly clearly that recorded by all authors listed in the synonymy. It does seem to be different from the species described by d'Orbigny (1839, p.93) in having only eight or nine chambers in the final whorl whereas *P. opercularis* has at least ten to eleven. However, until d'Orbigny's species is known better, no authoritative definition of a new species could be made.

Commonly, more than half the specimens recovered are in the form of plastogamic pairs. The species is mainly restricted to the Cape Grim section where it is quite common.

Occurrence - (a) Cape Grim - Cape Grim Beds 84008 (f), 84007 (c), 84006 (f), 84005 (f), 84003 (v), 84002 (r), 84001 (q),
(b) Preservation Island - 84479 (q).

Age - Early Miocene, N4/5, N8.

Pileolina patelliformis (Brady), 1884
(Pl. 5, figs. 20-23)

Discorbina patelliformis Brady, 1884, *"Challenger" Expedn, Scient. Results, Zool.*, 9, 647, pl. 89, fig. 1.
Discorbina patelliformis; Howchin, 1889, *Trans. Proc. R. Soc. S. Aust.*, 12, 12.
Discorbina patelliformis; Heron-Allen and Earland, 1924, *J. R. microsc. Soc.* (1924), (2), 170.
Discorbis patelliformis; Crespin, 1943, *Palaeont. Bull.*, Canberra, 4, 78.
Type locality and stratigraphic level - South of Papua, Pacific Ocean, Recent.
Remarks

Figure 3 is a plot of thickness against maximum diameter. The 28 specimens measured are all from Fossil Bluff (84011).

The species is most similar to *Pileolina zealandica* Vella and differs only in the amount of recurvature of the dorsal intercameral sutures.

A distinction between this species and most other species of *Pileolina* is that no plastogamic pairs were recovered at all.

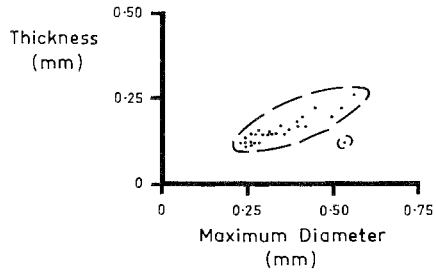

FIG. 3 -
Thickness vs maximum diameter for *Pileolina patelliformis* (Brady)

Occurrence - (a) Fossil Bluff - Freestone Cove Sandstone, 84010a (f), 84010b (q); Fossil Bluff Sandstone, 84011 (f), 84012 (r), 84013 (q), 84016 (r), 84017 (r), 84025a (q), 84024 (r), 84025b (v);
(b) Cape Grim - Cape Grim Beds, 84008 (v), 84006 (v), 84003 (f), 84002 (r), 84001 (r),
(c) Mt. Cameron West - 84117 (r).
Age - Early Miocene, N4/5.

Pileolina zealandica Vella, 1957
(Pl. 5, figs. 24, 25)

Pileolina zealandica Vella, 1957, *Palaeont. Bull.*, Wellington, 28, 37, pl. 8, figs. 175, 176.
Discorbis zealandica; Hornibrook, 1961, *Palaeont. Bull.*, Wellington, 34 (1), 99, pl. 13, figs. 254-256.
Type locality and stratigraphic level - off Poor Knights Island, Cook Strait, New Zealand, Recent.
Remarks
The specimens found here suggest that the species is more variable than envisaged by Vella or Hornibrook. The number of chambers in the final whorl varies in these specimens from seven to eleven, a considerably higher range than given by them as five to eight. The figured specimens of Hornibrook and Vella fit well within the field of variation of maximum diameter and thickness of the species found here.
Occurrence - (a) Mussel Roe Bay - 84483 (q), 84481 (r), 84482 (r),
(b) Marrawah district - 84561 (v).
Age - Late Oligocene - Early Miocene, N3-N5.

Pileolina sp.
(Pl. 5, figs. 26, 27)

Remarks
Chalk-filled and thus somewhat indistinct specimens were recovered from the Marrawah district (84092 and 84104). They belong to a species which is distinct from most species of this genus in having a smaller rate of increase of chamber height and probably more whorls than most. It also has a much higher maximum diameter/thickness ratio than most species.
Occurrence - Marrawah district - 84092 (q), 84104 (r).
Age - Early Miocene, N4/5, N8.

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